COMBINATION WIRELESS ALARM SYSTEM AND TELEPHONE CONNECTED TO AN INFORMATION MANAGEMENT NETWORK FOR AUTOMATED DELIVERY OF ALARM NOTIFICATIONS AND OTHER INFORMATION

Inventors: Pamela Layton, Keith Crawford, Sidney Skjei, Jeffrey Gadboys & Jack Jacobs

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FIELD OF THE INVENTION

The present invention relates generally to a combination system of a corded or cordless telephone; a monitoring alarm system for homes, apartments and business premises; a compact transportable wireless personal communicator for one-touch communication; a concealable dialing unit connecting to the public switched telephone network (PSTN) or in some versions, a wireless commercial network; and any of a plurality of peripheral wireless devices, such as security sensors, environmental sensors, medical monitoring sensors and home automation control modules; all interfaced with an interactive information management network ("IMN") routing system for alert, medical and other information to one or more remote points of contact. Capabilities of the system include externally directed control of alarm system operation and home automation devices via the information management network or remote telephone.

BACKGROUND OF THE INVENTION

Due to their complexity and the hardwired nature of sensors and/or the alarm control panel central to the operation of current systems, common home security monitoring systems require costly professional installation. The hardwired characteristics of the control panel prevent self-installation and/or relocation of the system should the owner change residences. Monitoring services are available through a limited number of specialized manned monitoring centers. Due to high equipment and personnel costs in these centers, monitoring fees are generally priced out of the economic reach of most consumers. Consequently, only 15% of the households in the United States have monitored security systems. Even fewer households have means to remotely monitor, e.g. from work, the medical condition of an ailing relative.

In the event of a system alert, current monitoring center procedures provide the customer with an alarm verification call, notification to local police or fire authorities and notification to a number of designated contact numbers. Current systems allow customers limited opportunities to alter contact numbers or to be contacted via the growing variety of communication devices available to the public (e.g., fax, e-mail, pager, and/or Personal Digital Assistant--PDA).

It would be a desirable improvement if there could be an automated secure monitoring network, which could efficiently and inexpensively notify designated points of contact via the wide variety of communications media. It would be a further improvement if users had direct, secure access to the monitoring network database via phone or the global computer network in order to review and change alarm system configuration, points of contact and emergency information any time they desired. It would be a further improvement if the use of the alarm system could be electronically logged in the base unit and in the Information Management Network so that it could be reviewed later.

The prior art alarm systems generally comprise a control

panel and several wired or wireless remote sensors. The control panel houses the control circuitry and interface circuits, such as telephone jacks and cellular or radio transceivers.

Prior art cordless telephones generally comprise a base unit and a cordless handset. The base unit is connected to the public switched telephone network via telephone jacks. The base unit and handset communicate by radio frequency, typically at 900 MHz (megaHertz) or 2.4 Ghz (gigaHertz). Prior art corded telephones generally comprise a base unit and a corded handset.

It would be a desirable improvement if there could be a combined unit of (1) the corded or cordless telephone base unit and (2) the control panel of a monitoring alarm system. There is significant redundancy between the circuitry of a corded or cordless telephone base unit and an alarm system control panel. The present invention combines the circuitry of both devices, resulting in an economic utility without compromising the integrity of either system. The combined capabilities of the telephone and alarm circuits provide a single device which can monitor a wide variety of security and environmental sensors, perform standard telephone functions and, when required, can automatically pass sensor alert messages via wired or wireless network communication channels to a fully automated monitoring and Information Management Network.

It would be a further improvement if this Information Management Network, having automatically received an alert call from the premises where the phone is located, would automatically access a data base, find the particular owner's profile, and then also automatically send alert messages to phones, faxes, email devices, pagers, hand-held computers and/or a manned monitoring center as previously specified by the owner. We are aware of no telephone-based security system that is combined with an Information Management Network that allows for the collection and routing of security, medical and other information to devices of an owner's choosing. The unique interface between the telephone

and alarm circuitry also allows the flow of command signals back to the alarm circuitry for remote control of alarm system operation and home automation control and wireless reporting devices. It would be a further desirable improvement if this system could be connected to a separate Calling Unit using radio frequencies, so that any attempt to remove power or functionality from the system would result in an automatic alert call.

The combination of telephone and alarm circuitry supports two-way communication capabilities between a Personal Communicator Device (PCD) and the telephone. The PCD offers the user a small, portable, wireless personal assistance communication device capable of one-button alerting of designated contact numbers and/or local police/fire authorities in the event of an emergency. The device also offers two-way voice communication with the contact party via the telephone base unit while also notifying the information management network that an alert call has been placed. The information management network allows notification of an emergency condition to be forwarded to designated points of contact of the owner's choosing (e.g., friends, neighbors or relatives). We are aware of no currently available personal assistance device which enables a person to direct-dial an emergency response number (e.g. 911 in North America) for help and also to automatically notify a friend or relative of the call.

It would be a desirable improvement if children, baby sitters, those who are medically challenged, the elderly and others could have the capability of direct dialing to a designated contact point from a small device with two-way communication. Moreover, it would be a desirable improvement if the routing of those calls could be easily modified on the telephone base unit or through the Information Management Network. It would also be desirable for the user to designate the routing of his emergency or security calls either sequentially or simultaneously. It would be a desirable improvement if there

were a telephone base unit connected to an Information Management Network that is capable of receiving transmissions of real-time medical information that is then automatically supplemented with patient information and routed automatically to one or more points of contact, such as hospitals, doctors' offices and/or relatives, simultaneously or sequentially.

A signal transmitted by the personal communicator device (PCD) may include an emergency code. For example, in the event of an emergency, such as a heart attack, a customer may press a "panic button" found on the PCD. Pressing the panic button may cause the base unit to transmit an emergency call to the network where information (text or voice) is routed to the pre-designated contact points either by public switched telephone network (PSTN), wireless communication network, or the global computer network. If the customer has subscribed to manned-monitoring station notification, the station operator will be able to speak directly to the customer via the PCD, which contains a speaker and microphone, in order to determine customer assistance requirements. In some embodiments, where separate panic buttons are available for identifying medical, police, fire or other types of emergencies, the nature of the emergency is automatically communicated to the designated responder. In other embodiments, the PCD notification to the Information Management Network initiates forwarding of additional information such as medical data, the customer's exact location in the home, or an access code allowing entrance into the residence as a supplement to the transmitted message.

Managed healthcare protocols have resulted in increasingly earlier release from hospitalization, or in many cases, no hospitalization at all. In-home health monitoring equipment, such as cardiac, blood oxygen level, fetal and blood pressure monitors, have become an integral part of acceptable medical care. The development of affordable home monitoring systems capable of communicating real-time medical status information to

a physician, hospital or other concerned party is of significant benefit to the public. We are aware of no commercially available wireline or wireless device that monitors medical sensor status and when necessary, automatically notifies an Information Management Network, which then forwards specific real-time medical information to designated medical contact points, as well as notifying friends or family of an abnormal condition. Further, we are aware of no commercially available device that accomplishes the transfer of this information from medical devices linked to the system by a Radio Frequency (RF) interface in a highly portable form. It would also be desirable for the Information Management Network to be programmed to make periodic automated calls into the home to determine occupant activity and/or the status of the medical equipment in the home.

Home automation devices are becoming an increasingly popular means to improving quality of life. To our knowledge, home automation systems do not offer a user the ability to control environmental or appliance devices from outside the premises using the public switched telephone network (PSTN), wireless or global computer network connections to a telephone base unit.

It would be a desirable improvement if there were a combination alarm/telephone Base Unit, connected to an Information Management Network via PSTN or the wireless infrastructure, that would enable one to control home automation devices and a home security system, easily and inexpensively, using the telephone or global computer network from a remote location.

SUMMARY OF THE INVENTION

The invention comprises a telephone base unit (Base Unit) that combines the circuitry and components of a corded or cordless telephone and the components of an alarm system control panel, capable of alarm and home automation functionality. In another configuration, the invention also includes an independent cordless personal communication device. The telephone Base Unit

includes data, radio and/or telecommunications interfaces for establishing voice, data, radio and other telecommunications links with, among other devices, remote alarm sensors, a Calling Unit, Telephone Isolation Switches, home automation control modules, a wireless personal communicator device (PCD), a cordless handset, a public switched telephone network, and in some instances, connectivity with the wireless/cellular infrastructure, Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL) or coaxial or fiber-optic cable for interface to the global computer network. In other embodiments, the Base Unit combines the preceding components with a separate, redundant calling unit for added security. The telephone system allows the user to dial into the alarm unit and turn it on or off, change its configurations and get system status reports. In other embodiments, the telephone base unit will communicate with wireless, independent medical devices for in-home medical monitoring. For example, one could check on an elderly relative.

Using the public switched telephone network (PSTN), the wireless infrastructure, Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL) cable modem or other interface to the global computer network, the base unit or independent calling unit (CU) communicates with an information management retrieval and transmission network, hereinafter referred to as the "Information Management Network"(IMN), using a series of Dual Tone Multiple Frequency [DTMF] tones that interface with the IMN to initiate a series of information delivery transactions. The IMN simplifies routing of alarm notifications by providing a single universal access point, giving users quick access to predetermined connections. The IMN is the combination of a DTMF modem, an application interface (API), a series of servers containing customer information databases, a unified messaging platform, an event log, a web interface, and a Private Branch Exchange/Interactive Voice Response (PBX/IVR) interface (See FIG. 8). This configuration

translates the DTMF tones received from the base unit into a message capable of being sent in voice or text format to any number of customer designated devices including telephone, fax, email addresses, pager, or Personal Digital Assistant (PDA) such as a PALM PILOT®. The IMN can be securely accessed via the global computer network or standard telephone transmission lines to program a user's customer profile, to include notification preference points, times for notification and other related information. Receipt of information by the user can be confirmed and a record kept in the event log database of the IMN and in the Base Unit.

The base unit has the ability to make a call to a dial-in node of the IMN, upon command from the Alarm Processor, nominally a microprocessor, microcontroller or application specific integrated circuit (ASIC). The alarm processor receives the input commands, whether initiated from the communicator, detected on-site by a smoke or burglar alarm or security or environmental sensor or automatically detected by a sensor or medical monitoring device, and then determines what action to command, makes the telephone connection and awaits confirmation of receipt. If the confirmation is not received back, the alarm processor keeps trying to connect and send the message or call. The user's identification number, phone number and sensor information (FIG. 12) are part of the message transmitted to the IMN . The IMN then retrieves user information and alert notification addresses (including but not limited to phone numbers, fax numbers email addresses, pager numbers, and Personal Digital Assistant device addresses) from the customer database and forwards the alarm notification or medical information to the designated points of contact, simultaneously or sequentially. For an alarm notification, the information conveyed includes the customer name, location of the base unit, phone number of base unit, date, time, type of sensor and zone. The user's profile residing in the IMN database can be modified at any time over the

telephone or global computer network. Confirmation that the alarm notification has been successfully transmitted to the customer's designated device(s) is housed in an event log in the IMN and in the base unit as well. In a preferred embodiment, the IMN allows for a two-way communication interface with the base unit. In this way, the present invention allows for remote activation or resetting of the alarm and other devices in the home for security and home automation purposes, through the initiation of a phone call or global computer network transmission to the IMN. In addition, the present invention includes the maintenance of an event log in the base unit, and another in the IMN, permitting retrieval of call data. The use of the IMN allows the user to preprogram alarm and home automation functions to initiate specific processes at specified times of the day. Similarly, the user can call the unit directly via telephone and initiate alarm and home automation transactions.

The base unit includes a status display, which indicates the operating and battery status of all portable wireless devices, security sensors and devices transmitting to the telephone. The Liquid Crystal Display (LCD) will provide visual alarm status while an audio alarm will alert the individual of a security or sensor infraction. In embodiments of the system which do not include the PCD, an alarm event triggers the microprocessor to generate an audible alarm and visual notification in text format on the LCD of the Base Unit, while calling the IMN. If an alert occurs while the telephone line is being used for a fax, conventional conversation, or any other purpose, the system automatically terminates the call, freeing the line, and initiates the dial out process to send the alert signal to the IMN. The Base Unit has control circuitry that is configured such that if, during a telephone call, the Base Unit receives an alarm signal, the Base Unit will either (1) if it is a one-line phone, disconnect the line and contact the IMN, or (2) if it is a 2-line phone, call the IMN on the second line. Since a house may have a

plurality of conventional phones connected to a single outgoing line, and it is necessary to be able to pre-empt all these extension phones, a small module with a wireless control signal receiver is preferably interposed between each extension phone and its respective wall jack. In this configuration, the base system wirelessly sends a cutoff signal to the module switch at each telephone jack, allowing the telephone line to be seized and cleared for alarm information transmission purposes. These modules are herein referred to as the "Telephone Isolation" (TI) switches.

In a telephone-based security system, there is always the possibility that an intruder will disable the alerting system by cutting the telephone line to the jack. To enhance security, in some embodiments, the system of the present invention may include a separate Calling Unit with its own dial-out capability, which communicates at regular intervals with the Base Unit. If, for example, the Calling Unit does not receive the expected message that it is still active from the primary Base Unit, due to unplugging of the Base Unit, the Calling Unit transmits a message to the IMN that the primary Base Unit is inoperative. The IMN can then undertake appropriate investigation and/or notification steps, according to its programming. This Calling Unit can also act as the interface to the Telephone Network for all alarm messages, eliminating the possibility of defeating the alarm by cutting the phone line at the Base Unit or destroying the Base Unit. In another embodiment, the Calling Unit communicates with the IMN via wireless network channels to protect against alarm interruption due to the severing of telephone lines external to the premises.

It is an object of the invention to make it easy for the average homeowner to install the above combination corded/cordless telephone Base Unit/premises-monitoring system/personal communication system. The Base Unit, when not being used for monitoring purposes, can also be used for

conventional telephone functions via the public switched local and long-distance networks, and in some configurations via the wireless networks or DSL infrastructure.

In summary, we are not aware of any other telephone-based security system that interfaces with an Information Management Network that enables an individual to modify contact instructions and notification numbers which are stored in the customer profile. We are also not aware of any telephone-based security system that is interfaced with an IMN to control a home security system and remote automation devices that could modify the home environment. We are also not aware of any other telephone-based system that is able to communicate with an information network using DTMF tones, which then cause the network to process and send specified information to a series of different communications media, storing these call data in an event log in the phone and network for later retrieval. We are also not aware of a telephone-based medical monitoring communication system that transmits real-time and current medical information to an Information Management Network, which then is capable of routing said information to multiple pre-designated points of contact. We are aware of no monitored home security/alarm system that is highly transportable and can be easily moved to a different residence by a homeowner, renter or small business owner.

The present invention addresses these shortcomings and combines all of the above components into a single comprehensive solution. Independent wireless units can be interfaced with the telephone Base Unit that allow for varied processes in connection with the same telephone. The user can select some or all of the available options, including condition sensors, security units, personal communicator transceivers, home automation and medical monitoring units. As other monitoring devices are purchased, the placing of a phone call or the input of information via the IMN website permits quick and efficient adding of the new peripheral devices to each owner's system.

BRIEF FIGURE DESCRIPTION:

FIG. 1 is a system diagram of the present invention, including wireless portable devices, telephone Base Unit, and Information Management Network;

FIG. 2 is a diagram showing the flow of signals and messages when a sensor alert is triggered;

FIG. 3 is a diagram of a reset, reconfiguration or inquiry via the telephone network;

FIGS. 4a & 4b are diagrams of the relationship between the Base Unit and the Calling Unit; FIG. 4a shows a first embodiment in which the Base Unit and the Calling Unit are in separate housings, while FIG. 4b shows a second embodiment in which the Base Unit and the Calling Unit are in a single common housing;

FIG. 5 shows the communication between the Base Unit and the Personal Communicator Device (PCD);

FIG. 6 is a diagram of the flow of the signals and messages when a Personal Communicator Device (PCD) is used to initiate a call for emergency assistance, for example to a "911" number;

FIG. 7 is a diagram showing how the Base Unit or calling Unit instructs a Telephone Isolation Switch to disconnect other telephone extensions and thereby make a telephone line available;

FIG. 8 is a diagram of the Information Management Network and the interface between the Base Unit and the IMN;

FIGS. 9A-9B show a preferred format of a customer profile;

FIG. 10 shows a preferred structure of the Base Unit; and

FIGS. 11-12 show a preferred structure of a DTMF signal from the Base Unit or Calling Unit to the network.

DETAILED DESCRIPTION:

FIG. 1 shows a typical, but not all-inclusive, embodiment of the system of the present invention. The system includes a base unit 9, sensors 25-29, a calling unit 30 located either within the base unit 30a or as a separate unit 30b, telephone isolation switches 33, a personal communicator device (PCD) 10, and an Information Management Network (IMN) 50. In this description,

PCD 10, sensors 25-29, and switches 33 are among the devices mentioned generically as "wireless peripheral devices" of the base unit 9. Base unit 9 may contain a telephone answering machine.

As shown in FIG. 10, the base unit 9 preferably includes a telephone processor 31, alarm processor 32, built-in siren (not shown), and multi-spectrum RF radio 90 including an RF amplifier. The telephone processor 31 is interfaced with the alarm processor 32 in such a way that it is possible to call into the base unit 9 from a remote location to turn it on, turn it off, reconfigure or reset it, or to obtain status and alarm event information. This base unit 9 contains control and interface electronics in the form of a microcontroller such as (but not limited to) the model ***PIC16C77*** *available from the Microchip company (Chandler, Arizona, USA). Base unit 9 may be either corded like a conventional telephone, or cordless. However, in either case, RF radio 90 permits base unit 9 to exchange voice communications on a first radio frequency (e.g. 900 MHz) with a first wireless peripheral device such as PCD 10, while simultaneously exchanging data communications on a second frequency (e.g. 300 MHz) with either PCD 10 or with a second peripheral device such as a sensor or a telephone isolation switch 33.*

FIG. 8 shows the IMN 50, which simplifies routing of alarm notifications by providing a single universal entry or access point, giving users quick access to predetermined connections. This network translates Dual Tone Multiple Frequency (DTMF) tones (a preferred format of which is shown in FIG. 11) received from the base unit 9 or calling unit 30 into a message that is sent in voice or text format to any number of user designated devices including telephone, fax, e-mail addresses, pager, etc. The IMN 50 may be accessed over a global computer network 91 (commonly known as "the Internet"), or by a standard telephone 81, to program a user's customer profile which includes notification

preference points, times for notification and other related information, for each home resident, as shown in FIGS. 9A-9B.

Receipt of information by the user may be confirmed and a record kept in database event logs (not shown) of the IMN 50 and in the Base Unit 9. The IMN 50 also allows for a secure, passcode-based, 2-way interface with the base unit 9. Suitable security protocols are well known in the art and are available from various commercial vendors such as VERISIGN, ENTRUST, and Baltimore Technologies. This enables the user to control home and security functions and system configurations from remote locations using one's telephone or the global computer network. The following are examples of such configurations:

Sample Configuration	Description
Disarmed	Smoke detectors and personal communicator are active
Periphery Armed	Door and Window Sensors are Armed
Intrusion Armed	Motion Sensors are armed
Door Notification	Door Chime is active when door is open
Home Appliances Timed	Home appliances such as lights are controlled by timer
Home Appliances Sensor Activated	Home appliances such as lights are activated by sensors, such as motion detector

The IMN 50 can also transmit to the user a variety of informational services 52 such as maintenance prompts, multimedia alerting of news or financial events, messages, and other information requested by the user.

TELEPHONE PROCESSOR 31

As shown in FIGS. 1, 4a, 4b, 5 and 10, the telephone processor 31 includes an integrated circuit or circuits which control all standard telephone functions such as speakerphone, corded or 900 MHz or 2.4 GHz cordless telephone interface, answering machine, line signaling, remote call in, caller ID, etc. The processing and switching device implementation of an existing corded or cordless answering telephone machine may be used, for example an **MC68HC05** microcontroller (available from MOTOROLA, INC., Phoenix, Arizona USA), with the remainder of the

processing and electronics for alarm and calling unit functions residing on an interface board external to the telephone processor 31, all within the housing of the base unit 9.

ALARM PROCESSOR 32

An alarm processor 32 (AP), as shown in FIGS. 1, 4a, 4b, 5, and 10, located in the base unit 9 performs a variety of functions. A suitable commercially available chip is model PIC16C77 from Microchip (Chandler, Arizona, USA). Among other functions, the AP manages and terminates alarm and alarm system operation events (an alarm, a test, and inquiry); maintains and changes the base unit's operational status from active to standby; and logs significant event details, including low battery warning. The AP interfaces with the telephone processor 31 using a standard bus, such as an I2C bus, to obtain time, keypad information, and/or to receive incoming data signals from the telephone network and to pass data or Dual-Tone Multi-Frequency (DTMF) information, e.g. in the format shown in FIG. 11. The AP responds to digital signals by outputting audible speech signals for responding to telephone or user inquiries. The AP also interfaces with the sensors 25-29 to receive alarm information and interfaces with a remote keypad (not shown). The AP manages system setup and configuration changes including those received through the IMN 50 or the normal telephone network 93. The AP interfaces with the calling unit 30a or 30b and provides transmission to the IMN 50 of message data such as test status, telephone number to be called, unit identification, alarm zone and other information, including sensor type. The AP interfaces with several RF telephone isolation switches 33 and accomplishes line seizure and manages downline reprogramming (a system in which programs are loaded into the memory of a computer system via phone or global computer network 91). The AP maintains a log of retrievable (synthesized voice or LCD) event and configuration information (not shown). The AP manages

appliance and sensor control for automation control devices, a number of which are commercially available, from various vendors.

CALLING UNIT 30

As shown in FIGS. 4a-4b, the calling unit 30 of FIGS. 1 and 5 can be made in a first configuration 30a, within a single housing with the base unit 9 (FIG. 4b) or in a second configuration 30b, located remotely from the base unit 9, in a separate housing (FIG. 4a). The primary rationale for a remote calling unit 30b is the ability to place the calling unit in a hidden location, to prevent intended or unintended disabling of the system by an intruder. This is accomplished by the unique design feature that, whenever a sensor emits an alert, the alarm processor 32 immediately generates an alarm message and sends this alarm message by wireless transmission to the remote calling unit 30b, which stores it in memory. If the remote calling unit 30b does not receive an alarm cancellation message from the alarm processor 32 within a brief specified period of time, the alarm information is transmitted to the IMN 50 via the telephone network 93. Conversely, if the alarm is cancelled by entering the correct "disarm" code on a keypad at the base unit 9 within the specified period of time, the base unit 9 sends an alarm cancellation message to the remote calling unit 30b and the alarm is cancelled, prior to transmittal to the IMN 50.

As shown in FIGS. 2 & 7, in the case of an actual alarm, the remote calling unit 30b receives the alarm message from the alarm processor 32, briefly waits for possible cancellation, then seizes the telephone line by use of the telephone isolation switches 33 (FIG. 7, right). The remote calling unit 30b then dials and delivers the message using DTMF coding to the IMN 50 and stands by, to receive a confirmation report from the IMN 50 that the alert has been received. The remote calling unit 30b passes this report to the alarm processor 32 for logging and activation of an ALARM RECEIVED light (not shown) on the base unit 9, and then releases the phone line for further use. In the

embodiment which includes an internal calling unit 30a rather than an external calling unit 30b, the process is the same, with the exception that the alarm message is not transmitted to the calling unit 30a wirelessly but by a hardwired interface, internal to the base unit 9.

As shown in FIG. 8, the calling unit 30 may be connected to a wired telephone network 62 or a wireless telephone network 94 or to a wired or wireless data network. In a configuration such as this, the calling unit 30 can dial out wirelessly in the event that the landline becomes unavailable (e.g., due to adverse weather conditions disrupting the public switched telephone network (PSTN), or due to a burglar's cutting telephone wires leading to an individual house). In a wireless interface, the calling unit 30 will pass information to the wireless network via any of numerous available protocols such as: CDPD (Cellular Digital Packet Data), Circuit Switched Cellular, Overhead Control Channel Technology and/or Forward Control Channel Technology. These data will be passed to a mobile telephone switching unit 94 and routed through a receiving modem 65 in the Information Management Network 50 to a processor which contains an application program interface (API) 66. This processor uses the data contained in the output signals from the modem to extract additional relevant data from a customer database 67. The processor then sends commands, containing customer-specific information, to an event notification server 68 within the IMN 50. The calling unit 30 may also be programmed to initiate transmittal of the alert message via both landline and wireless networks simultaneously, depending upon how much expense is tolerable and what level of reliability must be achieved. In either scenario, the alert message is routed to modem 65 as described above. If the base unit 9 is tampered with, the call will automatically be initiated from the calling unit 30. The calling unit 30 is not used for Emergency Exchange calls (e.g. to "911" in North America) or voice transmission calls.

TELEPHONE JACK ISOLATION SWITCHES 33

FIG. 1 shows the arrangement of the telephone isolation switches 33 within the overall system. FIG. 7 shows the interface between the base unit 9 and the telephone jack isolation switches 33. These switches 33 are controlled by wireless signals, preferably RF signals in the 300-350 MHz band, from the base unit 9, in order to disconnect any off-hook telephone or other terminal equipment at its RJ-11 jack. This is accomplished by a remote controlled double-pole double-throw (DPDT) switch or similar mechanism. Each isolation switch 33 comprises: an RJ-11 telephone jack interface module with internal RF receiver which will reside externally or internally to the wall jack surface, an input receptacle for acceptance of an RJ-11 plug, an output plug for interface with an existing RJ-11 jack (e.g. in the wall), and a power source such as a battery or line voltage converter. This device ensures that the calling unit 30 will be able to make a sensor or intentional alert notification when needed, even though someone else might be on the line or a burglar might have taken the telephone off-hook to try to prevent a call for help.

WIRELESS SENSORS & PERIPHERAL DEVICES

FIG. 1 shows schematically the sensors 25-29, capable of communicating via RF to the alarm processor 32 (FIG. 10) on any of a variety of radio frequency bands including, but not limited to, 300 MHz, 400 MHz, 900 MHz, 2.4 GHz or frequency bands designated for use according to the Bluetooth standard now under development. In order to eliminate signal interference, the base unit 9 is preferably capable of using separate frequency bands for simultaneous voice transmission and data transmission. For example, voice channel transmissions may be broadcast in the 900 MHz band, while sensor data transmissions may utilize the 300 MHz band simultaneously. Three leading security device makers are Digital Security Controls, Ltd. of Concord, Ontario, Canada ("DSC"), the ITI Technologies division of Interlogix, Inc., North St. Paul, Minnesota ("ITI"), and the Linear Corporation

*subsidiary of Nortek, Inc., located in Carlsbad, California ("**Linear**"). The following wireless sensors/devices are commercially available and will operate within the frequency capabilities of the alarm processor (32):*

Smoke sensor (25), Linear Model DXS-72;
Freeze detector (26), ITI Model 60-742-95R;
Glass break detector (27), DSC model AMS 100 or
Glass break with shock detector (27), Linear model DXT-91;
Rate-of-rise heat sensor, ITI Model 60-460-319.5,
CO (carbon monoxide) detector, ITI model 60-652-95;
Motion - Passive Infrared (PIR), Linear model DXS-54;
Smoke with sounder, DSC model WLS 906;
Magnetic door/window sensor, Linear Model DXS-31
Water detector, ITI model 60-744-95.

It would also be possible to use the above-described system to connect to optional medical sensors, such as those for blood pressure 28, blood sugar (glucose) level 29, pulse, etc. Such sensors are available from Hewlett-Packard, Medtronic and other vendors. The system could also connect to home automation control modules, including light, environmental, appliance and audio/visual control devices (not shown), various models of which are available from ITI and DSC (mentioned above) and other companies.

PERSONAL COMMUNICATOR DEVICE 10

*As shown in FIG. 5, a preferred embodiment of the present invention includes a portable wireless device, the Personal Communicator Device 10, which contains a HELP button 12, a TALK button 14, a microphone 16, a speaker 18, and a built-in antenna 20. When one of the buttons is pressed, this generates either a Data Alert Message 22 or opens a Direct Dial Voice Line 24. Data may be sent, for example, at 300 MHz and voice at 900 MHz or 2.4 GHz, although in subsequent embodiments, both data and voice transmissions may utilize 900 MHz, 2.4 GHz or other available frequencies. A suitable transmitter circuit is model **MC13146** and*

a suitable receiver circuit is model ***MC13145****, both available from MOTOROLA, INC. (Phoenix, Arizona, USA). These circuits are operable in both the 300 MHz band and the 900 MHz band. If the TALK button 14, or optionally another button (not shown), is pressed, the base unit 9 dials an emergency number (e.g. "911" in North America) directly and, in some configurations, upon termination of the "911" call, an alert notification is sent from the base unit 9 through the calling unit 30 to the Information Management Network 50, which then sends an automated message to alert the owner or designated individual that an emergency call has been made. This alert can be sent via in any desired form, such as voice, data or fax messaging, to any of a variety of receiving terminals, such as a pager, cell telephone, Personal Digital Assistant (PDA), email, Wireless Application Protocol (WAP)-enabled device, or fax. Alternatively, if the HELP button is pressed, a data alarm message 22 is sent to the IMN 50 and is forwarded from there to the customer's choice of receiving devices.*

CALL CENTER BUTTON 84

As shown in FIG. 8, the base unit 9 contains a CALL CENTER button 84. This button may operate as an autodialer to connect the Base Unit 9 to an Interactive Voice Response (IVR) system 82 (FIG. 8) through the IMN 50, for the user to access customer service and other automated services through the network, including modifying his profile in a database.

FIGS. 9A-9B show a suitable format for the information provided by a customer or user, which is stored in the Information Management Network. All transactions between the base unit 9 and the IMN 50 will be logged into a database event log 79 in the IMN, and into a similar log in the base unit 9.

INFORMATION MANAGEMENT NETWORK 50

The Information Management Network (IMN) 50 is shown in FIGS. 1 & 8, and is the combination of a DTMF modem 65, a message renderer 69, an Application Program Interface (API) 66, a series

of servers containing customer information databases 67, a unified messaging platform, an event log, a web interface, and a Private Branch Exchange/Interactive Voice Response unit 82. In combination with the base unit 9, the calling unit 30, telephone isolation switches 33 and sensors 25-29, the IMN 50 provides an automated notification system capable of receiving alert inputs from wireline, wireless, or cable communication networks, and capable of delivering an alert message notification to specified points of contact via the wide range of commercially available communications media.

In a wired embodiment of the communications interface, a sensor alert transmission to the alarm processor 31 results in the calling unit (30a or 30b) converting the alert message to DTMF signals 61A. These signals are then forwarded to a Local Exchange Carrier (LEC) 62 which in turn, transmits the data over a Public Switched Telephone Network (PSTN) 64 to the IMN 50 via a predetermined phone number into a DTMF Modem 65. An acknowledgement/negative acknowledgement (ACK/NACK) query is exchanged with the calling unit 30a or 30b, indicating that the modem 65 has received the information. This ACK/NACK exchange indicates to the base unit 9 that the data have been received, and the base unit 9 stores this information in an event log in the alarm processor 32 and illuminates an ALERT RECEIVED indicator (not shown) on the Base Unit 9.

The modem then converts the DTMF analog signals 61A to digital signals and passes the data to an Application Program Interface (API) 66 residing on a customer database server 67 operating according to a standard commercially available database program such as SQL (Structured Query Language). The API 66 evaluates a data stream header field, forming part of the received digital signals, and extracts specific alert information such as station ID and type of alarm (motion sensor, window sensor, etc.). The API 66 provides this data to other programs

running on the SQL customer database server 67, for further processing.

The customer database server 67 then generates and sends an alarm notification to an event notification server 68 which contains pre-designated customer contact information. The event notification server 68 forwards the data to a message renderer 69, which converts it into the format(s) required for respective appropriate event servers 70. These include, but are not limited to a phone server, a fax server, a pager server, an e-mail server, a cell server, or even a manned monitoring center 71. As shown at the bottom of FIG. 2, a human security representative (not shown) in the manned monitoring center 71 will be alerted that customer's location has had a sensor alert transaction. After successfully sending the alerts and notifications, the IMN 50 issues a confirming report that an alert has been received and passes this information to the database event log 79 for retention as transaction history. The server/database 67, event log 79 and the alarm processor 32 will maintain a record of confirmation that the alert messages were in fact received. The customer database server 67 will pass notification of any message transaction to a customer access database 78.

As shown in the right half of FIG. 8, the customer access database 78 can be accessed via the global computer network 91 with a Web interface through a protective firewall 75 and ETHERNET® connection 76 or via standard telephone lines through a PBX/IVR 82 interface. Access to the customer access database 78 facilitates input and modification of user notification profile information and retrieval of sensor alert records to determine alarm activation and test history. Any input or modification to user notification profile records will be initiated in the customer access database 78, which in turn, will forward relevant profile information to the customer database server 67 for event retrieval. This functionality inhibits unauthorized electronic access to the customer database and server 67. The use of a

Personal Identification Number (PIN) validation query (not shown) provides the user with secure and personal access to his database information. As previously noted, suitable security protocols are well known and are available from vendors such as VERISIGN, ENTRUST, and Baltimore Technologies.

MANNED MONITORING CENTER 71

Optionally, as shown in FIGS. 1 & 8, the user can elect for the IMN 50 to notify the Manned Monitoring Center 71 (MMC) of the alarm. The operator at the MMC 71 will then call the unit location and speak with the customer or listen through the base unit 9 or PCD 10 microphone for abnormal sounds in the customer's residence, in order to verify the alarm. If the alarm is determined to be valid, the MMC 71 notifies the appropriate public safety officials (fire, police, campus or nursing home security).

MODE OF OPERATION--MAJOR EVENTS/SCENARIOS:

System operation is organized around several "events" or system operational scenarios, as described below:

ALERT EVENT

A flow diagram of an alert event sequence is depicted in FIG. 2. An alert event is initiated when a sensor is activated at step 101 or a distress button is pressed, such as HELP button 12 on the Personal Communicator Device 10 (FIG. 5). The signal from one of these peripheral devices passes, in the form of an RF signal, to the alarm processor 32 (see FIG. 5, left and FIG. 10, left). The alarm processor 32 correctly decodes and validates the alarm signal at step 103 (FIG. 6). If the signal denotes a security sensor activation, and the system is in the ALERT ARMED mode, an audible siren (not shown) is sounded within the base unit 9 and remotely, if an optional remote siren (not shown) is installed. If the system is in the UNARMED or CHIME ONLY mode, the alarm processor 32 takes no action or rings the chime, respectively. If the event is initiated by a smoke sensor 25

(FIG. 1), the internal siren (not shown) will sound, regardless of armed or disarmed status.

In the event of activation of a security sensor 27 (FIG. 1) while the system is armed or activation of a smoke sensor 25, the alarm processor 32 assembles an alarm message at step 104, sends it to the calling unit 30 and waits a brief period of time for alarm cancellation. If the alarm is not cancelled within the prescribed period, the base unit 9 seizes the line and sends a signal (preferably 300 MHz) to the telephone isolation switches 33, as shown in FIG. 7, directing the switches to isolate all telephone jacks.

According to an alternate scenario (FIG. 8, top left), the base unit 9 initiates a wireless data call through a wireless transmitter using Personal Communications Services (PCS), cellular or long range radio protocols 61B. The base unit 9 dials an access number of the IMN 50. In any event, this alarm message includes the unit ID, unit telephone number, alarm type, zone, whether it is a test, and the IMN 50 access number to be dialed. The calling unit 30 receives the alert information from the alarm processor 32 via a wired or wireless interface and validates it in step 103.

In the embodiment comprising a separate calling unit 30b, the signal is transported wirelessly via RF between the alarm processor 32 and the calling unit 30b. The calling unit 30b then stores the message in step 105 and waits a brief period of time for alarm cancellation. Cancellation is accomplished if an authorized user enters a correct code 112 (FIG. 2, top right) via the keypad on the base unit 9 or a remote keypad unit (not shown), and the entry is logged at step 113. If the alarm is not cancelled within the prescribed period of time, the calling unit 30 seizes the telephone line at step 106 and sends a signal to the telephone isolation switches 33 to isolate all premises telephone jacks.

According to another alternate scenario, the calling unit 30

initiates a wireless data call through a wireless transmitter using PCS, cellular or Long Range Radio (61B) protocols. The calling unit 30 dials the access number for the IMN 50. When a connection is established with the IMN 50 via the modem 65, the alert event message data is passed to the API 66 for conversion and transfer into the event notification server 68, as shown in FIG. 8. The calling unit 30 stays connected, awaiting an acknowledgment (ACK/NAK) verification message from the IMN 50 that the alarm message has been received, authenticated and validated. This is indicated by the leftward-pointing arrow from modem 65 in FIG. 8. In step 107, the calling unit 30 then initiates a log entry in the alarm processor (32) and, in step 108, releases control of the phone line. Then, in step 109, the IMN 50 sends alerts as previously instructed by the owner of the base unit.

If the customer chooses to subscribe for the services of a manned monitoring center (MMC) 71, the IMN 50 directs an alert notification message to the MMC 71. Then, in step 110 (FIG. 2), the MMC 71 will attempt to send alert messages to verify the alert condition via a direct telephone call to the base unit 9. Following standard monitoring center protocols, a verified alert event notification will result in a call to public safety officials such as fire, police and/or emergency medical technicians (step 111).

To end the event, a password-protected re-set can be accomplished through the base unit 9 or remotely via the PSTN line (step 112), and is logged in the alarm processor for display on the base unit (step 113). Alert siren termination is accomplished via the password reset or via a pre-selected time-out function (ex. 5, 10, 15 minutes).

RESET, INQUIRY OR RECONFIGURATION EVENT (FRONT PANEL)

FIG. 3 presents the flow of information in a reset, inquiry or reconfiguration event. A reset, inquiry, or reconfiguration event occurs when the alarm processor 32 configuration or

operational status is changed, or the alarm processor 32 is asked to provide alarm or configuration information to an authorized user who has the correct password or to the IMN 50. The two-way information flow capability of the desired invention is accomplished by the telephone processor 31 passing DTMF control and inquiry signals to the alarm processor 32. In a reset or re-configuration event, the user generates keypad input signals to enter or change a password, reset the unit, turn the unit on or off, delete or add zones and Sensors, change alarm options or thresholds. Alarm processor-directed synthesized voice prompts guide the user through the available change/inquiry options. Alternatively, the user can call the IMN 50 using a PBX/IVR, or access the IMN 50 via the global computer network to accomplish reset, reconfiguration, and other control options (115).

PERSONAL COMMUNICATOR DEVICE 10 ALARM EVENT

The Personal Communicator Device 10 contains three or more special function buttons which facilitate the following communication transactions:

911 Emergency Exchange Call

Programmed Speed Dial to contact desired phone numbers (i.e., doctor, family, friend)

Personal Distress Alert Notification

FIG. 5 shows the interface between the personal communicator device 10 and the base unit 9. Programmed Speed Dial calls and 911 Emergency Exchange calls are accomplished by the telephone processor 31 in a manner consistent with a normal base unit 9 telephone call.

As shown in FIG. 6, activation of a "911" emergency exchange call initiates an alert message to the IMN 50 for notification to the designated points of contact advising that a 911 emergency exchange call has been placed from the base unit 9. The third type of alarm, the Personal Distress Alert, is processed by the alarm processor 32 as a sensor alert signal to the IMN 50. Notification procedures for this type of sensor

alert message are depicted in FIG. 2. Specific contact and response actions are defined by the instructions which the user has programmed into his personal database profile. If the user has subscribed to the manned monitoring center 71 option, the IMN 50 will forward an alert message to the MMC 71 for verification and assistance.

It will be apparent to those active in the security and medical monitoring fields that various changes and modifications are possible within the scope of the inventive concept. In particular, features of one embodiment could be combined with features of another embodiment. Therefore, the invention is not limited to the specific embodiments shown and described, but rather is defined by the following claims.